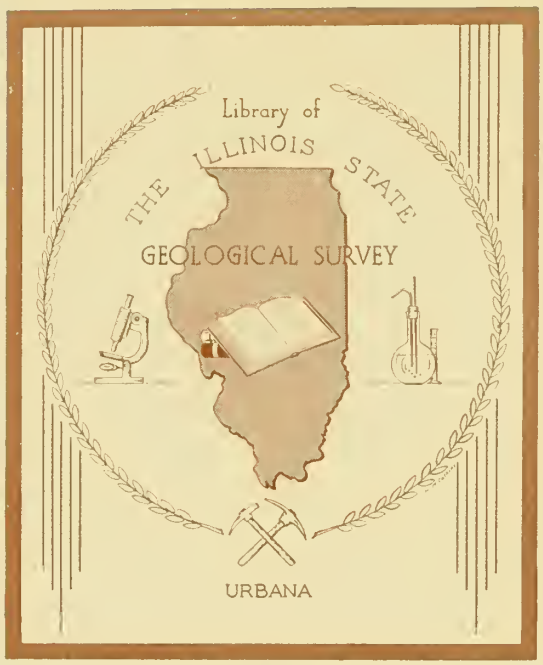
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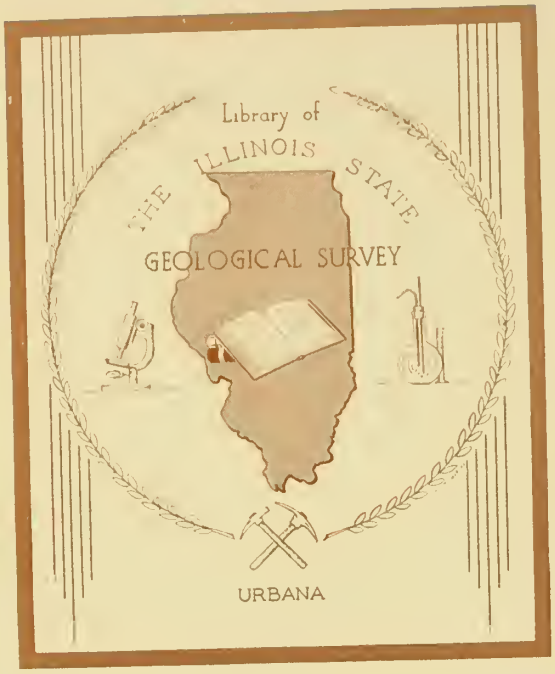
GROUND-WATER SUPPLIES ALONG THE INTERSTATE HIGHWAY SYSTEM IN ILLINOIS

KEROS CARTWRIGHT

ILLINOIS STATE GEOLOGICAL SURVEY

JOHN C. FRYE, Chief • Urbana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GROUND-WATER SUPPLIES ALONG THE INTERSTATE HIGHWAY SYSTEM IN ILLINOIS

Keros Cartwright

Water supplies capable of producing 40 to 60 gallons per minute are required for planning rest areas along the new Interstate Highway System, a requirement difficult to meet where ground-water conditions are unfavorable. The greatest difficulties in locating water supplies have been encountered in the southern part of Illinois where permeable water-yielding beds are scarce. The Illinois State Geological Survey, the Illinois State Water Survey, and the Illinois Division of Highways are cooperating in locating sites with adequate water in all parts of Illinois.

INTRODUCTION

The Illinois State Geological Survey has cooperated with the Division of Highways of the State Department of Public Works and Buildings since 1962 in evaluating the availability of ground water for rest areas on the Interstate Highway System. The areas will provide facilities along highways for drinking water, rest rooms, and picnicking.

Planning the rest areas involves several considerations. They must be placed along highways at convenient intervals, preferably in esthetically pleasing locations. Each must consist of two sites—one for each direction of traffic—spaced so that a driver sees the stop on his side before he sees the one for the opposite direction. Locations close to urban areas are eliminated to discourage use of the stops as local parks.

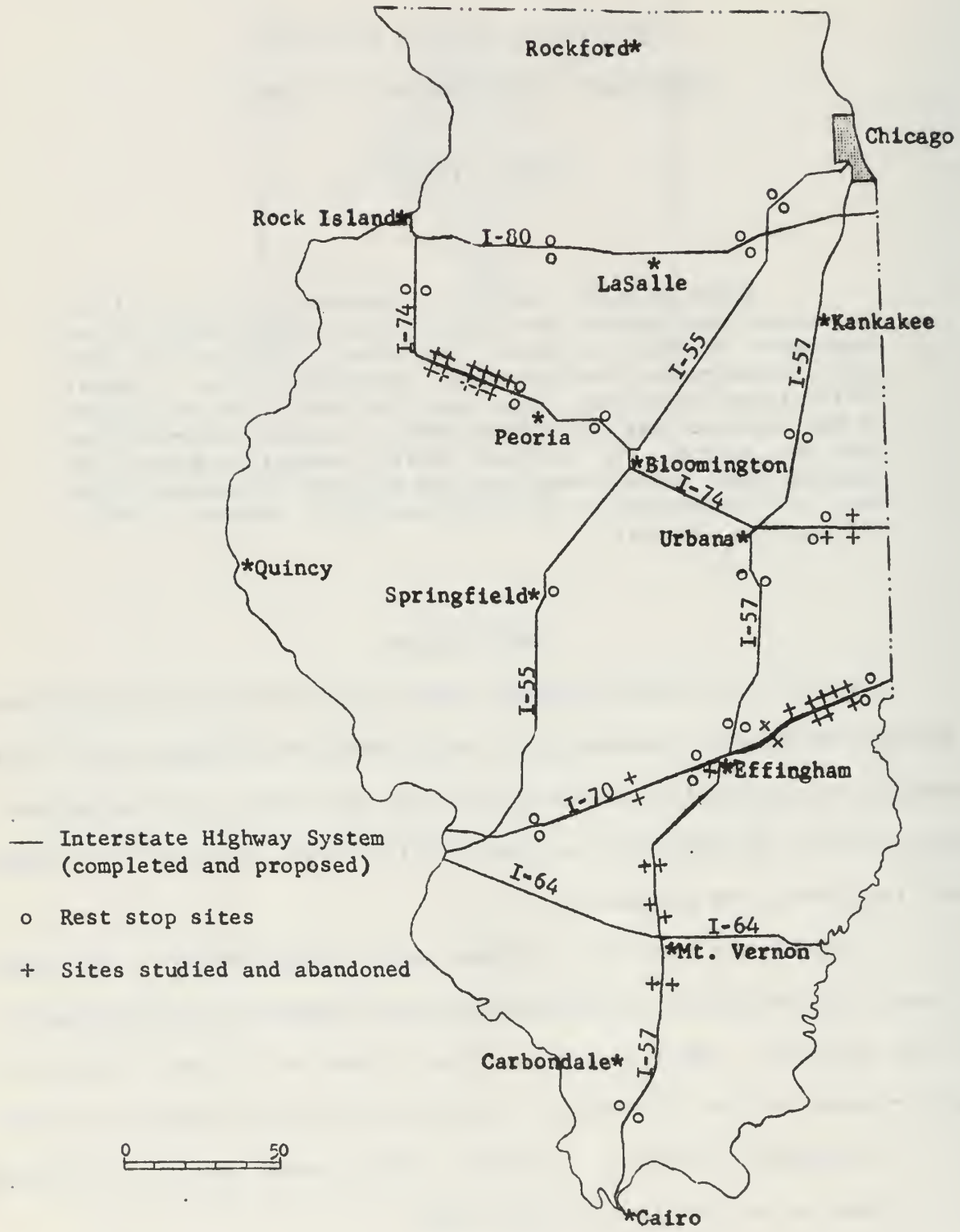

Fig. 1 - Location of rest stop sites that have been studied.

A ground-water supply must be available for both drinking and sanitary facilities. Water demands vary greatly, not only from season to season but also from hour to hour during the day. A well capable of supplying 40 gallons per minute (gpm) is needed at each site to meet heavy demands. At some sites even more water, perhaps 60 gpm, is needed. Unless absolutely necessary, large, costly water storage facilities are to be avoided, and, therefore, wells must be capable of meeting peak demands.

Early in the planning program it was apparent that in some parts of Illinois rest stops could be provisionally selected with the assumption that a water supply was available. In other parts, however, availability of water was the most limiting consideration for site selection and the other factors had to be accomodated to it.

To date, 19 areas for pairs of rest stops have been evaluated (fig. 1), many of them including several alternative sites. In the northern part of the state, large areas exist where a water supply can be found almost anywhere (figs. 2 and 3), whereas in parts of south-central and southern Illinois even meager supplies are difficult to obtain. This variability of physical conditions made it advisable to incorporate geohydrologic information into highway planning very early and to maintain considerable flexibility in site selection.

SOURCES OF GROUND WATER

Evaluation by the Geological Survey of ground-water possibilities at each site was accomplished with available geologic and hydrogeologic data. Most sources of information consist of the results of regional ground-water studies and well data filed in the mineral resource records of the Geological

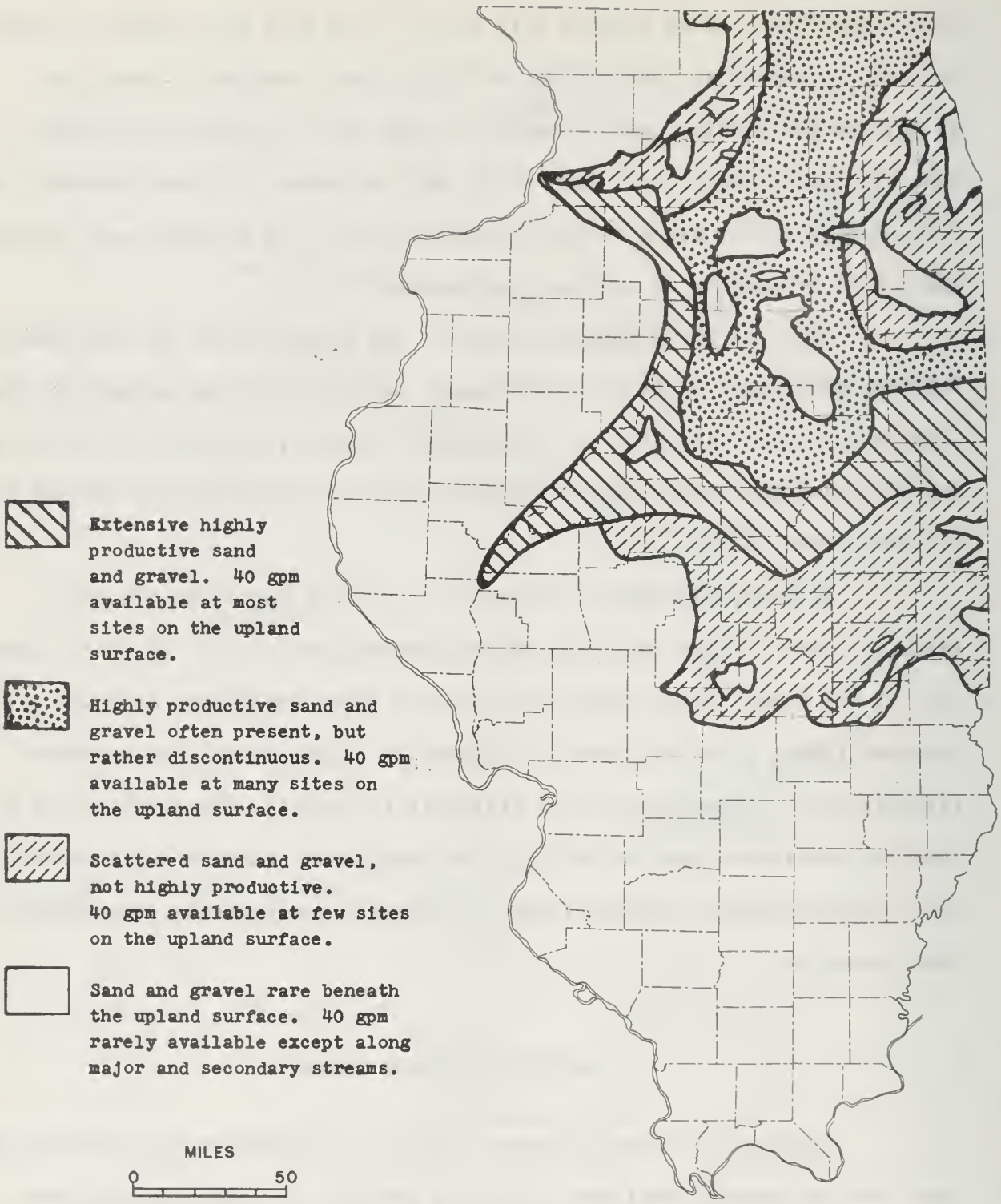

Fig. 2 - Ground-water potential for rest stops from glacial drift on the upland surface (after Atlas of Illinois Resources, 1958).

Survey. Following geologic evaluation, geophysical exploration was sometimes carried out to locate potential aquifers (strata capable of storing water and transmitting it to a well) in the unconsolidated glacial drift.

Two main sources of ground water in Illinois are the unconsolidated sand and gravel deposits of glacial drift and river alluvium, and sandstone and limestone formations within the bedrock. Fresh water occurs in these aquifers from depths of only a few feet to as much as 2000 feet in parts of Illinois.

Most of the unconsolidated deposits, which attain a maximum thickness of over 500 feet, were left by glaciers that overrode parts of Illinois during the four major stages of ice advance. At its maximum, the ice covered Illinois as far south as Carbondale. Sand and gravel deposits occur mainly in valleys that carried meltwater from the ice.

In areas of thick drift, sand and gravel deposits may be extensive and deeply buried (fig. 2). In other areas, where the drift is thin, only scattered sand and gravel generally is present. Modern-day streams commonly flow along drift-filled valleys that existed in glacial times, and thus the most permeable material often is confined to these valleys, especially in areas of thin drift. Figure 2 shows the probability of finding sites on the upland surface with sufficient sand and gravel to yield 40 gpm of water. However, sites even in the area marked as excellent may not have adequate water-yielding material, since the thickness and permeability of the deposits can vary greatly over short distances. The northeastern and east-central parts of Illinois contain rather extensive sand deposits; in the rest of the state, sand and gravel deposits are more limited.

Ground-water conditions in bedrock also vary considerably in the state. Bedrock formations dip into the Illinois Basin, an oval, spoon-shaped structural depression, the deepest part of which is in Hamilton, Wayne, Edwards, and White

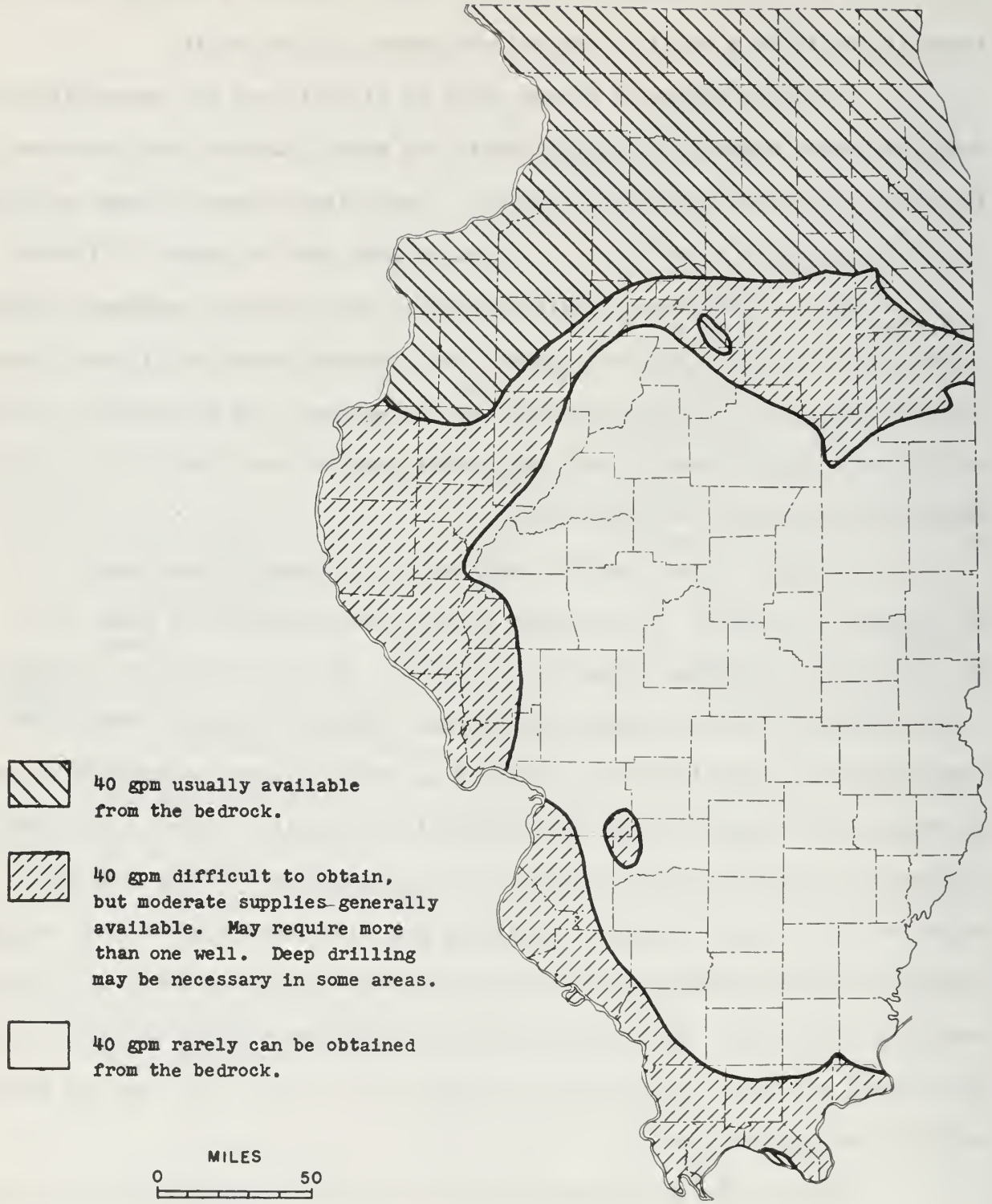

Fig. 3 - Ground-water potential for rest stops from bedrock formations (after Atlas of Illinois Resources, 1958).

Counties. As water moves through the formations toward the deep part of the basin it becomes more saline. Thus, water is potable to depths of 2000 feet in permeable sandstones and dolomites (a limestone-like rock) in the northern part of the state, but is brine in the same rocks in the Illinois Basin where they occur at great depths. Potable water also is found in bedrock aquifers along the western and southern edges of the state (fig. 3).

The nature of bedrock formations is more consistent than that of drift, and predictions of depth and water-yielding characteristics can often be made with some certainty. This is especially true of the sandstones that yield water from the pores of the rock.

Limestone generally yields water from solution zones and crevices. The extent of these and, therefore, the water-yielding characteristics of the limestone cannot be predicted prior to drilling. When limestone is the uppermost bedrock formation, crevicing is best developed in the upper 50 to 75 feet. When the limestone is covered with impermeable shale, the crevices generally are poorly developed. Table 1 lists rock units, their water-yielding characteristics, and the regions in which they are important as aquifers.

DEVELOPMENT OF THE REST STOP PROJECT

Availability of water was a serious problem at some sites (figs. 2 and 3). In parts of the southern half of the state it was not always possible to locate an adequate water supply. At such sites, plans were modified so that smaller quantities of water would be acceptable.

Initially the Highway Division picked pairs of sites that met their criteria for rest stops, assuming that a water supply was available. The locations of the proposed sites were sent to the Geological Survey for information

TABLE 1 - WATER-YIELDING CHARACTERISTICS OF ILLINOIS ROCK UNITS

System	Unit	Thickness (ft)	Description	Water-yielding characteristics
Quaternary	Pleistocene	0-500	Unconsolidated glacial deposits; pebbly clay (till), silt, sand and gravel; alluvial silts and sands along streams.	Water-yielding characteristics vary. Large yields from thicker sand and gravel deposits in bedrock valleys. Chief aquifer in the southern two-thirds of Illinois. Supplies often adequate for rest stops.
Tertiary and Cretaceous		0-800	Clays, fine sands, silts, and some gravel.	Water-yielding characteristics vary. Thick deposits of sand present excellent possibilities for domestic and farm supplies and, locally, possibilities for municipal and rest stop supplies. Present mainly at the southern tip of Illinois.
Pennsylvanian	McLeansboro and Kewanee Groups	0-1500	Mainly shale with thin limestone, sandstone, and coal beds.	Water-yielding characteristics vary. Locally domestic and farm supplies are obtained from sandstone and limestone beds. Water quality deteriorates with depth. The only bedrock aquifer in much of Illinois. Locally thick sandstones in area between St. Jacob, Madison County, and New Memphis, Clinton County, yield small municipal supplies, usually not adequate for rest stops, except in the St. Jacob area.
	McCormick Group	0-1200	Shale with thin limestone, sandstone, and coal at top; thick sandstones in the lower part.	Water-yielding characteristics vary. In southern part of Illinois, yields sufficient water for municipal and rest stop supplies.

(Continued)

TABLE 1 - WATER-YIELDING CHARACTERISTICS OF ILLINOIS ROCK UNITS - Continued

System	Unit	Thickness (ft)	Description	Water-yielding characteristics
Mississippian	Pope Megagroup	0-1400	Shale, sandstone, and limestone.	Yields water from sandstone and limestone strata. Sandstone characteristics vary. Widespread use as source of domestic and farm supplies in southern and southwestern Illinois. Sandstones sometimes yield adequate water for small municipal and rest stop supplies.
	Mammoth Cave Megagroup	0-450	Limestone; some shale in the lower part.	Dependable aquifer for domestic and farm supplies. Locally a source of water for municipal and rest stop supplies. Upper formation generally well creviced where it directly underlies the drift. A source of water in western Illinois from Marion County to Jersey County and in the southern tip of the state.
	Kinderhookian Series	0-400	Shale; little limestone.	Not water yielding.
Devonian		0-1400	Limestone, cherty limestone, some sandstone; shale in upper part.	Dependable aquifer for domestic and farm supplies. Locally a potential source of water for municipal and rest stop supplies. Generally moderately creviced. Used as a source of water in the Rock Island area and extreme southern Illinois.
Silurian		0-470	Dolomite and limestone; shaly near base.	Dependable aquifer. Generally well creviced where encumbered below the drift. Highly developed and dependable aquifer in northeastern and northwestern Illinois.

(Continued)

TABLE 1 - WATER-YIELDING CHARACTERISTICS OF ILLINOIS ROCK UNITS - Concluded

System	Unit	Thickness (ft)	Description	Water-yielding characteristics
Ordovician	Maquoketa Group	0-250	Shale; some dolomite.	Generally not water yielding.
	Ottawa Megagroup (Galena and Platteville Groups)	0-450	Limestone and dolomite.	Dependable aquifer where not overlain by shale. Not highly developed. Usable as an aquifer in the northern part of Illinois and at some points along the Mississippi River.
	Ancell Group (Glenwood and St. Peter Formations)	0-650	Sandstone; sometimes shaly at top and bottom.	Dependable aquifer. Highly developed in the northern third of the state. Source of many municipal supplies.
	Prairie du Chien Group	0-1200	Dolomite; some sandstone.	Rarely developed as a source of ground water. Some use in north-central Illinois.
Cambrian	Croixan Series (Eminence and Franconia Formations)	0-2000?	Dolomite; some sandstone and shale.	Rarely developed as a source of ground water.
	(Ironton and Galesville Formations)	0-275	Sandstone present in northern part of Illinois only.	Highly productive and developed aquifer in the northern third of Illinois.
	(Eau Claire Formation)	300-1000?	Shale, dolomite, and siltstone; lower part sandstone.	Not a source of ground water except for sandstone at base.
	(Mt. Simon Formation)	500-2500	Sandstone; some shale.	Moderately productive aquifer; generally too deep to be developed. Used in the northern third of Illinois.
Precambrian			Crystalline basement.	Not a source of ground water.

on the ground-water potential. The Survey analyzed the hydrogeologic data and the State Water Survey furnished information on the quantity and quality of available water. Following analysis of the geologic data, electrical earth resistivity surveys (Buhle, 1957; Buhle and Brueckmann, 1964) were made by the Geological Survey at some of the sites. The resistivity surveys were conducted in areas of glacial drift to indicate the best place to drill when available data suggested potential water supplies, or to further evaluate a site when geologic data were insufficient to show the character of the drift. Table 2 lists sites evaluated for the Highway Division, types of studies made, conclusions reached, and outcome of drilling, if any.

It soon was obvious to district engineers in charge of specific areas, mainly in the southern part of the state, that the most desirable site from the esthetic and engineering standpoint often had the least adequate water supply. For example, sites on rock promontories overlooking valleys were often selected. At these sites, however, no drift is present and little water is available. In addition, the rock itself has very low permeability. As the cooperative work with the district office continued, the engineers began to submit several pairs of potential sites for ground-water evaluation so that highly unfavorable sites could be eliminated. In some cases, the Geological Survey suggested areas in which ground water might be obtained, and thus the availability of ground water became the critical factor in rest stop planning.

The effort expended in the search for and evaluation of sites varied greatly from one part of the state to another. In Will County, for example, only one geological report was necessary for the sites. This report principally listed the aquifers present, their thickness, and their depth. Ground water is available at almost any site in this region, and thus was not a critical part

TABLE 2 - PROPOSED REST STOP SITES

Location	Type of evaluation	Results of study	Remarks
Interstate 55			
SW sec. 29 T. 37 N., R. 10 E. Will County	GWP*	Chances excellent for obtaining a supply from the Silurian dolomite at depths less than 100 feet; deeper aquifers also available	
N 1/2 sec. 31 T. 37 N., R. 10 E. Will County	GWP	Same	
NW SW sec. 6 T. 16 N., R. 4 W. Sangamon County	GWP EES†	Conditions poor at site; recommended exploration in valley of Sangamon River one-quarter to one-half mile north; drilling prior to EES unsuccessful	60 gpm needed; supply obtained from deposits in river valley; well located by EES
Interstate 57			
100'N, 100'W SE cor. SE sec. 4 T. 24 N., R. 10 E. Iroquois County	GWP	Conditions excellent in glacial drift; site lies over a major drift aquifer associated with a buried valley; EES not recommended	
1600'S, 400'E NW cor. NW sec. 10 T. 24 N., R. 10 E. Iroquois County	GWP	Same	
NE sec. 16 T. 17 N., R. 8 E. Champaign County	GWP EES	Chances of obtaining a supply from the drift good; recommended EES for locating well site	Adequate water supply found at recommended site
NW NE sec. 21 T. 17 N., R. 8 E. Champaign County	GWP EES	Same	Same

* GWP = Geological report on ground-water conditions
† EES = Electrical earth resistivity survey

(Continued)

TABLE 2 - PROPOSED REST STOP SITES - Continued

Location	Type of evaluation	Results of study	Remarks
Interstate 57-contd.			
NE NW sec. 26 T. 9 N., R. 6 E. Effingham County	GWP EES	Chances of obtaining a supply very good; suggest EES	EES inconclusive; well drilled on basic geologic interpretation; adequate water but high mineral content; plan to use site
SE SE sec. 26 T. 7 N., R. 5 E. Effingham County	GWP EES	Chances of obtaining a supply poor except in the valley of the Little Wabash River, across highway, and three-quarters mile west	Site abandoned; will build site across road from previous site
NW SE sec. 27 T. 2 N., R. 2 E. Marion County	GWP EES	Chances poor	Abandon
NE SE sec. 3 T. 1 S., R. 2 E. Jefferson County	GWP	Same	Same
NW NW sec. 11 T. 1 S., R. 2 E. Jefferson County	GWP	Same	Same
NW SW sec. 30 T. 5 S., R. 3 E. Franklin County	GWP	Same	Same
SW NW sec. 6 T. 6 S., R. 3 E. Franklin County	GWP	Same	Same
SW SW sec. 17 T. 12 S., R. 1 E. Union County	GWP	Chances good for obtaining supply from sandstone or limestone of the Chester Series	Successful well completed at site
NW NW sec. 20 T. 12 S., R. 1 E. Union County	GWP	Same	Same

(Continued)

TABLE 2 - PROPOSED REST STOP SITES - Continued

Location	Type of evaluation	Results of study	Remarks
Interstate 70			
SW sec. 17 T. 4 S., R. 5 W. Madison County	GWP	Chances good for obtaining supply from Pennsylvanian sandstone	
NW sec. 19 T. 4 S., R. 5 W. Madison County	GWP	Same	
NW SE sec. 9 T. 6 N., R. 2 E. Fayette County	GWP EES	Chances poor	Abandon
SE NE sec. 9 T. 6 S., R. 2 E. Fayette County	GWP EES	Same	Same
SW NE sec. 13 T. 7 N., R. 4 E. Effingham County	GWP EES	Chances fair for obtaining a supply from the drift	Small water supply found; will use site
NW SW sec. 8 T. 7 N., R. 5 E. Effingham County	GWP EES	Same	Same
NE sec. 9 T. 9 N., R. 9 E. Cumberland County	GWP	Chances poor at site; supply probably available in Embarras River Valley one-quarter to one-half mile east	Abandon
NW sec. 6 T. 9 N., R. 9 E. Cumberland County	GWP	Same	Same
NW sec. 6 T. 9 N., R. 10 E. Cumberland County	GWP	Chances poor	Abandon
NW cor. sec. 25 T. 10 N., R. 10 E. Cumberland County	GWP	Chances fair to good in glacial drift; EES recommended but not requested	Abandon

(Continued)

TABLE 2 - PROPOSED REST STOP SITES - Continued

Location	Type of evaluation	Results of study	Remarks
Interstate 70-contd.			
SE SW sec. 23 T. 11 N., R. 13 W. Clark County	GWP	Chances fair to good for obtaining a supply from the drift	Drilled and supply found inadequate
NE SE sec. 23 T. 11 N., R. 13 W. Clark County	GWP	Chances fair to poor for obtaining a supply from the drift	Drilled and no aquifer found
NE NW sec. 19 T. 11 N., R. 12 W. Clark County	GWP	Chances poor at site; supply probably available in valley of Mill Creek one-half mile west	Abandon
NE sec. 19 T. 11 N., R. 12 W. Clark County	GWP	Chances poor at site; supply probably available in valley of Mill Creek three-quarters mile west	Abandon
SE SW sec. 17 T. 11 N., R. 12 W. Clark County	GWP	Chances poor	Abandon
Same	GWP	Same	Same
NE SE sec. 17 T. 11 N., R. 12 W. Clark County	GWP	Same	Same
SW SW sec. 11 T. 11 N., R. 12 W. Clark County	GWP EES	Same	Same
SW sec. 5 T. 11 N., R. 11 W. Clark County	GWP EES	Chances poor at site; supply probably available in valley of Mill Creek	Tests to be made in valley of Mill Creek
NE cor. SE sec. 3 T. 11 N., R. 11 W. Clark County	GWP EES	Chances fair to good for obtaining a supply from the drift	To be tested

(Continued)

TABLE 2 - PROPOSED REST STOP SITES - Continued

Location	Type of evaluation	Results of study	Remarks
Interstate 74			
NE NW sec. 1 T. 14 N., R. 1 E. Henry County	GWP	Chances fair in the drift; chances good in the Devonian-Silurian dolomites at depths of 300 feet or greater	Drilling proved supplies available in drift
NE SW sec. 12 T. 14 N., R. 1 E. Henry County	GWP	Same	Same
NW NE sec. 33 T. 11 N., R. 3 E. Knox County	GWP	Chances poor in drift; very deep well possible	Abandon
S 1/2 NE sec. 34 T. 11 N., R. 3 E. Knox County	GWP	Same	Same
Same	GWP	Same	Same
SE sec. 35 T. 11 N., R. 3 E. Knox County	GWP EES	Same	Same
SE SW sec. 5 T. 10 N., R. 4 E. Knox County	GWP EES	Same	Same
Same	GWP EES	Same	Same
Cen. sec. 10 T. 10 N., R. 4 E. Knox County	GWP EES	Same	Same
NW SW sec. 11 T. 10 N., R. 4 E. Knox County	GWP	Same	Same
SW NE sec. 18 T. 10 N., R. 5 E. Peoria County	GWP	Same	Same

(Continued)

TABLE 2 - PROPOSED REST STOP SITES - Continued

Location	Type of evaluation	Results of study	Remarks
Interstate 74-contd.			
NW SE sec. 18 T. 10 N., R. 5 E. Peoria County	GWP	Chances poor in drift; very deep well possible	Abandon
SE NW sec. 17 T. 10 N., R. 5 E. Peoria County	GWP	Same	Same
SE SE sec. 29 T. 10 N., R. 6 E. Peoria County	GWP	Chances poor in drift; very deep well possible	Probably will drill 1700-foot deep well
NW NE sec. 32 T. 10 N., R. 6 E. Peoria County	GWP	Same	Same
SE NW sec. 20 T. 25 N., R. 1 W. Woodford County	GWP	Chances fair to poor in drift; supply probably available in valley of Mackinaw River one-half mile west	Adequate supply found
SE NE sec. 20 T. 25 N., R. 1 W. Woodford County	GWP	Chances fair to poor at site; supply probably available in valley of Mackinaw River 1 mile west	Adequate supply found
NW SW sec. 7 T. 19 N., R. 14 W. Champaign County	GWP EES	Chances fair to good for a supply from the drift	Adequate supply found
Cen. sec. 10 T. 19 N., R. 14 W. Vermilion County	GWP EES	Chances fair to good for a supply from the drift	Abandon
SW NE sec. 10 T. 19 N., R. 14 W. Vermilion County	GWP EES	Chances fair to good for a supply from the drift	Adequate supply found
SE NE sec. 7 T. 19 N., R. 13 W. Vermilion County	GWP EES	Chances poor	Abandon

(Continued)

TABLE 2 - PROPOSED REST STOP SITES - Concluded

Location	Type of evaluation	Results of study	Remarks
Interstate 74-contd.			
NE sec. 8 T. 19 N., R. 12 W. Vermilion County	GWP	Chances poor	Abandon
Interstate 80			
NW NE sec. 8 T. 16 N., R. 8 E. Bureau County	GWP	Chances very good for obtaining supply from the drift	Adequate supply found
NE NW sec. 10 T. 16 N., R. 8 E. Bureau County	GWP	Same	Same
SE SW sec. 8 T. 34 N., R. 8 E. Grundy County	GWP	Chances fair in drift, very good in shallow bedrock; deep bedrock aquifer available	Adequate supply found
NW SW sec. 4 T. 34 N., R. 8 E. Grundy County	GWP	Chances poor in drift, very good in shallow bedrock; deep bedrock aquifer available	Adequate supply found

of the planning. Wells for the sites in Will County on Interstate 80 are located in secs. 29 and 31, T. 37 N., R. 10 E., and were made in the shallow Silurian dolomite. The unconsolidated glacial drift at the sites was estimated to be about 50 feet thick. No information was available on the characteristics of the drift, but most wells in the region are finished in the upper 50 feet of the bedrock. The uppermost bedrock formation is the Silurian dolomite, which is a highly productive aquifer offering an excellent source of ground water for the rest areas. The Glenwood—St. Peter Sandstone is another possible aquifer at a depth of about 650 to 700 feet. No geophysical exploration was necessary.

In contrast to Will County, Effingham County illustrates an extreme case where the hydrogeologic environment was the controlling consideration in rest stop planning and design. Reports of numerous sites in Effingham County along Interstate 57 were prepared, and resistivity surveys were conducted at several locations before a site was finally located. The original sites selected were located in sec. 26, T. 9 N., R. 6 E. (southbound site) and sec. 26, T. 7 N., R. 5 E. (northbound site). Since the Pennsylvanian bedrock in this area is not productive, water supplies were sought in the glacial drift. The drift had some promise at the southbound site because the site was over an ancient buried bedrock valley. However, geophysical studies were inconclusive. Drilling proved the existence of permeable sand and gravel deposits, but the water was of poor quality and would have required expensive treatment. The closest permeable deposit to the northbound site was three-fourths of a mile west of the highway on the floodplain of the Little Wabash River. As alternatives to these sites, two other pairs were examined, one in Marion County and one in Franklin County. These sites, however, proved to have less adequate ground-water potential, and both northbound and southbound sites were finally located in sec. 26, T. 9 N., R. 6 E., one of the first sites studied.

As the Interstate Highway System is expanded in Illinois, additional rest stops will require further ground-water investigations. The variability of ground-water conditions, as demonstrated by past investigations, indicates that availability of water will be a primary consideration in preliminary site selection.

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